

DENTSPLY

GENDEX

GX 770TM

**intra-oral x-ray
system
user manual**



IMPORTANT! . . . X-RAY PROTECTION

X-ray equipment may cause injury if used improperly. The instructions contained in this manual must be read and followed when operating the GX-770. Gen-dex dealers will be glad to assist you in placing the GX-770 in operation.

The GX-770 provides a high degree of protection from unnecessary X-radiation. However, no practical design can provide complete protection, nor prevent operators from exposing themselves or others to unnecessary radiation.

It is important that you be fully acquainted with applicable government radiation protection regulations. Many provisions of these regulations are based on the recommendations of the National Council on Radiation Protection and Measurements. Recommendations for dental X-ray protection are published in NCRP Report Number 35 available from NCRP Publications, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814.

Personal radiation monitoring and protective devices are available. You are urged to use them to protect against unnecessary X-radiation exposure.

GX-770 INTRA ORAL X-RAY SYSTEM

GENERAL

The purpose of this manual is to recommend proper operating procedures and to provide the required information for the GX-770 Intra Oral X-ray System.

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IDENTIFICATION LABELS

GX-770 components have identification labels that specify the model number, serial number and applicable product approval listings. On specified components, subject to U.S. Government Radiation Performance Standards 21 CFR, Subchapter J, a certification statement is included with other required information.

CATALOG ITEMS FOR OPTIONAL PURCHASE

Catalog No.

D0773LS	Remote pushbutton switch with exposure light
D0774B	8 in. (20 cm) clear cone
D0774A	12 in. (30 cm) clear cone
A0771AT	Remote Station Kit
A0772A	4 x 4 Mount
A8108AA	Remote Exposure Switch

GX-770 COMPONENTS

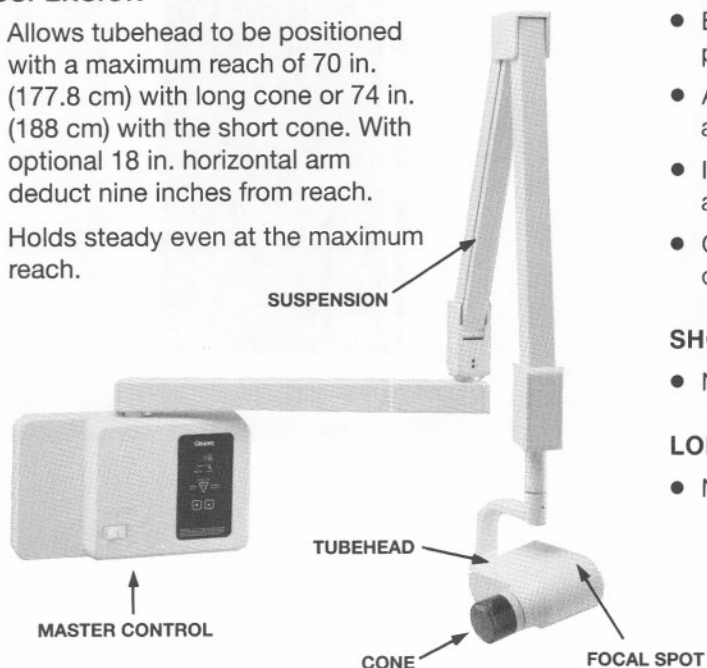
MASTER CONTROL

Contains electronic circuitry that:

- Automatically compensates for changes in line voltage.
- Controls kVp.
- Controls exposure time.

SUSPENSION

- Allows tubehead to be positioned with a maximum reach of 70 in. (177.8 cm) with long cone or 74 in. (188 cm) with the short cone. With optional 18 in. horizontal arm deduct nine inches from reach.
- Holds steady even at the maximum reach.



TUBEHEAD

- Aluminum filtration (increases x-ray beam quality and reduces the patient radiation exposure).
- Internal shielding absorbs x-radiation other than the primary beam.
- Focal spot (X-ray Source) location indicated by step in the alignment (sighting) lines.

CONE

- Establishes the distance from the x-ray tube to patient's skin.
- Assists in positioning the tubehead at the proper angle.
- Indicator lines at 90° around the cone facilitate accurate beam alignment.
- Collimates the x-ray beam to within a 6.5 cm diameter circle at the end of the cone.

SHORT CONE (8 in. focal length)

- Normally used with the bisecting angle technic.

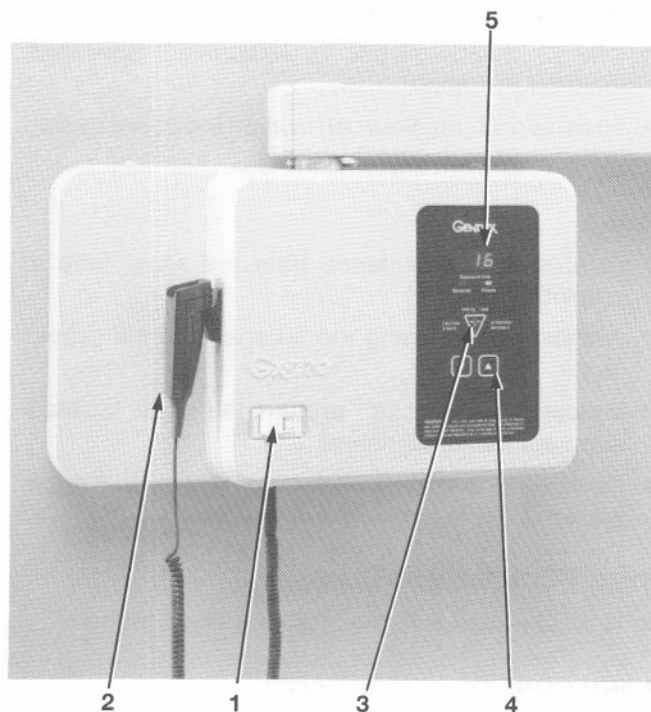
LONG CONE (12 in. focal length)

- Normally used with the paralleling technic.

GX 770 CONTROLS

1. **POWER SWITCH** – Depressing the switch to the “on” position will supply power to the control. An Amber Lamp in the switch will indicate that the system is ready for use.
2. **HANDSWITCH** — used to control exposure. Attached to the master control through a 10-foot coiled cord so the operator can be in a safe position during exposures.
 - Pressing the switch will start the exposure. Keep the switch depressed until the exposure stops automatically.
 - Releasing the switch prior to the end of the selected time will terminate the exposure immediately.
 - If a remote station is installed, the handswitch will be removed.
3. **X-RAY LAMP** – lights during the tube preheat and exposure time.
4. **EXPOSURE TIME SELECTOR BUTTONS**
 - Selects desired exposure time in 1/60 second pulses or fractional seconds. (Selected during installation).
 - 28 possible settings from 3 to 99 pulses or .05 to 1.65 seconds. (Selected during installation).
5. **EXPOSURE TIME READOUT**
 - Displays selection exposure time.
6. **REMOTE STATION – EXPOSURE SWITCH**
 - Pressing the switch will start the exposure (Keep switch depressed until exposure terminates automatically).
 - Releasing the switch prior to the end of the exposure will terminate the exposure immediately.

MASTER CONTROL



REMOTE STATION



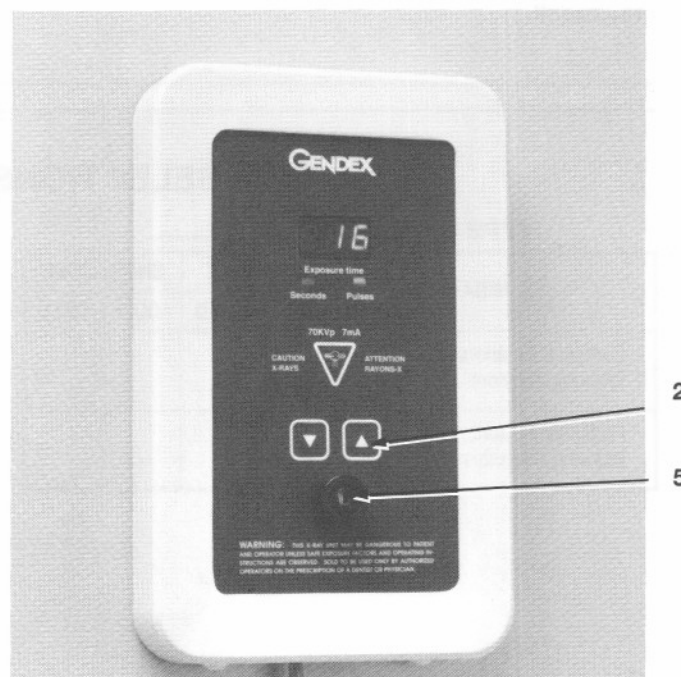
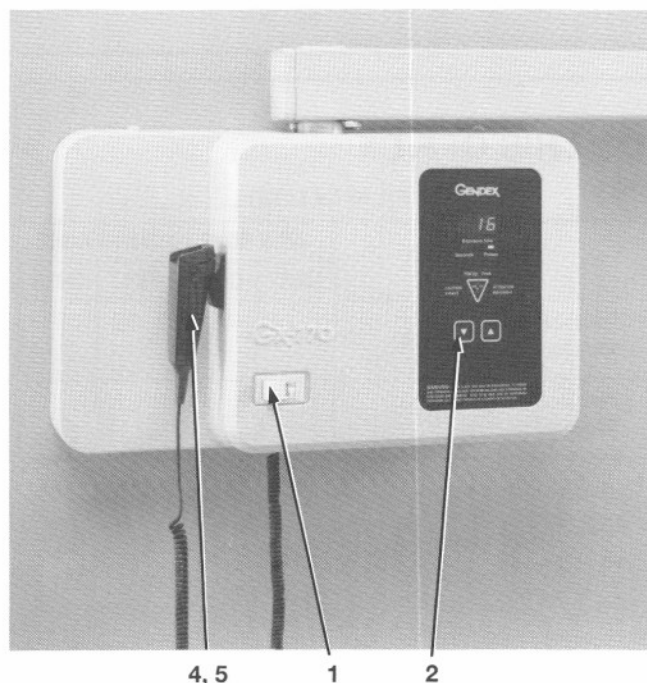
OPERATION SEQUENCE

NOTE: For purposes of this operation sequence, if there is a remote station installed, the exposure time and "70 kVp — 7mA" will be indicated at the remote station rather than at the master control. Also, the handswitch at the master control will have been removed and replaced by the exposure switch at the remote station.

1. Depress the power switch to the "on" position to energize the system. The Amber Switch Lamp indicating power "on" will light and the digital readout (exposure time) will now be displayed.
2. Select the desired exposure time, (See page 4), using the time selector buttons just below the digital readout.
3. Position the tube head and film as desired. Normally the end of the cone should be just touching the patient.
4. (If there is no remote station) - While holding the handswitch, move to a position that is either:
 - a. At least six feet away from the tubehead and out of the primary beam, or;
 - b. Behind protective shielding.

NOTE: You should have the patient in view immediately before the exposure to be sure the patient or tubehead has not moved.

5. Press and hold the handswitch (exposure switch). The x-ray light and audible signal will be energized immediately. At the end of the selected exposure time, the x-ray light will go out and the audible signal will stop. **DO NOT RELEASE THE HAND SWITCH UNTIL THE SELECTED EXPOSURE TIME TERMINATES AUTOMATICALLY. IF THERE IS ANY APPARENT PROBLEM, ESPECIALLY IF THE TIMER DOES NOT TERMINATE PROPERLY, RELEASING THE HAND SWITCH WILL STOP THE EXPOSURE IMMEDIATELY.**



SUGGESTED EXPOSURE TIMES

These charts are a guide by which the user may develop their own radiographic technic. If the suggested exposure time does not produce the density desired, use space provided to write in the time value preferred. Timer dial values provide approximately equal density changes with each successive step.

NOTE: Be sure film processing solutions are fresh and proper processing methods are used. Otherwise, test films will give misleading indication of optimum exposure time. See the Film Processing Guide in this manual.

Alternate exposure settings should be used to compensate for patient variances such as abnormal size, and edentulous areas. For edentulous areas use about 1/2 the exposure times shown below.

Be sure to note which cone is being used. The long cone extends beyond the tubehead about 6-1/2 inches, the short cone extends about 2-1/2 inches.

Since the GX 770 has a recessed tubehead, the long cone has short cone flexibility.

The end of the cone should be positioned as close to the patient's face as possible, otherwise lighter films may result.

All suggested times are in 1/60 second pulses. Available settings are 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 44, 50, 56, 62, 70, 78, 86 and 99 pulses.

TIME SELECTIONS WHEN USING FILM SPEED GROUP D (Such as Kodak Ultra Speed)

EXAMINATION	LONG CONE		SHORT CONE	
	ADULT	CHILD	ADULT	CHILD
Periapical Anteriors or Bitewing Anteriors	40	20	20	10
Periapical Posteriors or Bitewing Posteriors	44	22	22	11

TIME SELECTIONS WHEN USING FILM SPEED GROUP E (Such as Kodak Ektaspeed)

EXAMINATION	LONG CONE		SHORT CONE	
	ADULT	CHILD	ADULT	CHILD
Periapical Anteriors or Bitewing Anteriors	20	10	10	5
Periapical Posteriors or Bitewing Posteriors	24	12	12	6

TIME SELECTIONS FOR THIS OFFICE

TYPE OF FILM IN USE: _____

EXAMINATION	LONG CONE		SHORT CONE	
	ADULT	CHILD	ADULT	CHILD
Periapical Anteriors or Bitewing Anteriors				
Periapical Posteriors or Bitewing Posteriors				

TYPE OF FILM IN USE: _____

EXAMINATION	LONG CONE		SHORT CONE	
	ADULT	CHILD	ADULT	CHILD
Periapical Anteriors or Bitewing Anteriors				
Periapical Posteriors or Bitewing Posteriors				

RADIOGRAPHIC TECHNICS

Two basic technics are used for periapical radiography with the GX 770. They are the bisecting angle technic and the paralleling technic.

The paralleling technic is the preferred method and maximizes the geometrical accuracy of the image. When using this technic, the dental film is placed, without bending, parallel to the long axis of the teeth. The central X-ray beam is then directed at right angles to the film.

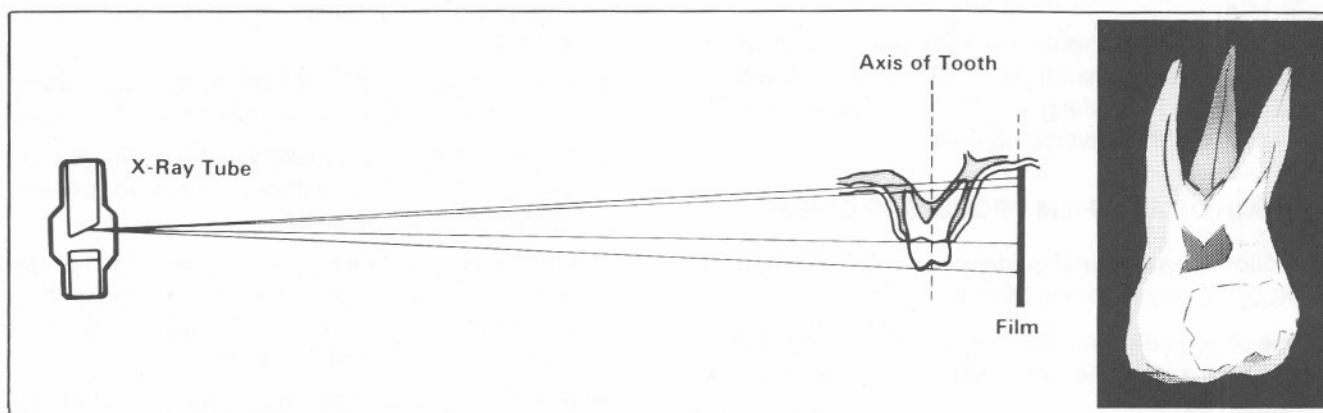
Compared to the bisecting angle technic, the distance from the teeth to the film is increased. Also, the X-ray source to skin distance is increased. These increased distances, and the relationships between target, object and film, reduce enlargement and distortion.

The paralleling technic requires the use of the long cone.

The bisecting angle technic is also commonly used. The bisecting plane is defined as the plane that bisects the angle between the central axis of the tooth and the plane of the film. The X-ray beam is directed at a right angle to this bisecting angle.

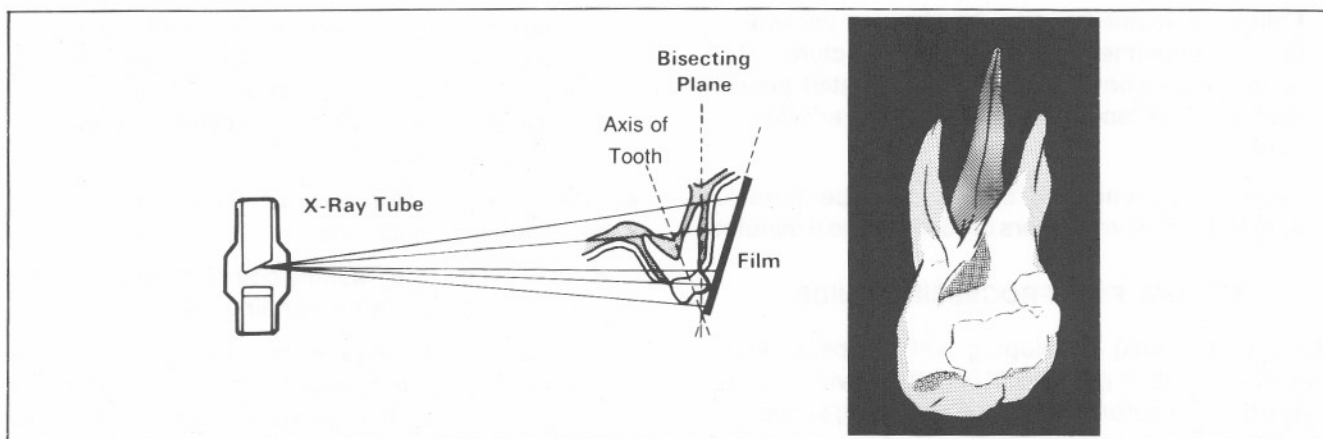
The bisecting angle technic can produce satisfactory results, but does introduce varying degrees of dental structure enlargement and distortion on the radiograph.

The bisecting angle technic may be used with either the long cone or the short cone.



Paralleling Technic

26278-D10



Bisecting Angle Technic

26279-D10

FILM PROCESSING GUIDE

High quality diagnostic radiographs cannot be obtained without proper film processing. Either dip tanks or an automatic film processor can be used. The following guidelines apply to either method:

1. The processing chemicals must be fresh and properly mixed. Pre-mixed chemicals do not develop as well as concentrates that are mixed just before use.
2. Be sure the processing chemicals are replenished and stirred daily.
3. The processing chemicals must be changed regularly or at the first sign of contamination and/or chemical fog.
4. Check the processing chemicals for proper temperature. They should be checked with a thermometer of verified accuracy before developing.
5. The darkroom should be light tight and have a proper safelight, such as a GBX filter used with a 15W bulb. The safelight should be located at least 4 feet from the developing area.

AUTOMATIC FILM PROCESSOR GUIDE

The following additional guidelines should be followed when using any automatic film processor:

1. Use only recently mixed chemicals designed for use with an automatic processor, such as Gendex Supermax™.
2. Prior to start-up each day, run a processor clean up film, or an exposed but unprocessed film through the processor to aid in keeping the rollers clean.
3. Follow the maintenance procedures at the time intervals recommended by the manufacturer. (The temperature control should be calibrated periodically in accordance with the manufacturer's instructions.)
4. Typical recommended time and temperature for automatic film processors is 83°F for 5 to 6 minutes.

MANUAL FILM PROCESSING GUIDE

Manual (dip tank) developing with properly mixed chemicals at 68°F (20°C) will usually provide a better image than an automated (roller-transport) processor. The following are some additional guidelines to insure consistent, high quality radiographs.

1. Stir the solutions thoroughly before using. Use separate mixing paddles to avoid contaminating the developer with the fixer. Check the temperature of the solutions with an accurate thermometer. A temperature control mixing value is recommended to maintain solutions at 68°F (20°C) for 5 minute developing.
2. The levels of the solutions must be checked. Cover solutions when not in use and replenish them daily. Do not use concentrated ("instant" fast developing) chemicals. They may produce streaking, chemical fog and less density than the standard, 5-minute, 68°F solutions.
3. The following steps may only be performed under proper safelight conditions:
 - a. Remove films from packets and attach them carefully to a clip hanger. Do this in a clean, dry work area.
 - b. Set the timer for the recommended developing time based on the temperature of the developer.
 - c. Immerse the film completely in the developer. Do this smoothly and without pause to prevent streaking. Start the timer.
 - d. Immediately agitate (raise and lower) the hanger several times so that the film is thoroughly bathed. Be sure the film does not touch the tank walls or film on another hanger.
 - e. Remove the film from the developer when the timer rings. Immediately place the film in the rinsing tank with running water. After twenty seconds, lift the film from the rinse and allow it to drain.
 - f. Place film in the fixer solution and agitate the hanger. The film should remain in the fixer for 10 minutes. Films may be wet-viewed after clearing, but **must** be returned to the fixer before they dry to complete hardening.
4. The remaining step may be done under normal room lighting conditions:
 - a. Place film in the washing compartment. Wash for at least 20 minutes in running water.
 - b. Suspend the hanger from a drying support. The processed film should be dried in a dust-free area in a way that prevents contact with other films. When the films are dry, remove them from the hangers for mounting.

IF THERE IS A PROBLEM

Dental X-ray problems include both film quality and equipment. Many of these problems can be corrected using the following problem guide.

OPERATIONAL PROBLEMS

Any Deviation From Normal Performance should be immediately investigated by a qualified service representative.

Power Switch Lamp Will Not Light – If the system is powered through a line cord, check to be sure it's plugged in completely. Also check the building circuit breaker or fuse. Be sure the switch is turned on. If it still will not light, call your dealer for service.

X-ray ON Lamp and Audible Signal Are Not Energized by Pressing the Handswitch – Check that the POWER SWITCH LAMP IS ON. (If not, see above.) If this does not cause the X-ray lamp and audible signal to be energized, when the handswitch is depressed, call your dealer for service.

Light or Blank Films or Inconsistent Density – Be sure the Power Switch lamp is on and that the X-ray lamp and audible signal operate normally (if not, see above.) When an exposure is made, be sure that the handswitch is depressed during the entire exposure. DO NOT RELEASE IT UNTIL THE EXPOSURE TERMINATES AUTOMATICALLY.

X-ray Continues Past Selected Time – Should X-ray ON lamp and/or audible signal not terminate automatically, immediately release handswitch, push power switch "OFF" and disconnect power. Do not attempt to use until the problem has been corrected. Call you dealer for service.

The X-ray ON Lamp or Audible Signal are Energized at Any Time Other Than When the Handswitch is Pressed – Remove power from the system by pushing the power switch "OFF", and unplugging the line cord or disconnecting the fuse/breaker at the distribution panel. Call your dealer for service.

Tube Head Feels Warm or Makes a Humming Sound Even Though No Exposures are Made – Turn off control and disconnect all power. Call dealer for service immediately.

Tube Head Positioning is Difficult or Noisy – Normally, positioning the tube head is smooth and quiet. Therefore, noisy operation or difficult movement could be symptomatic of a serious problem that might lead to an injury to patient or operator. Call dealer for service immediately.

FILM DIAGNOSTIC PROBLEMS

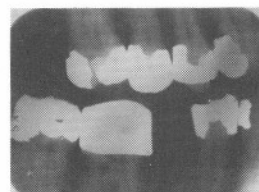


25238-P10

Radiographic Result

Radiographic Goal

Film is Too Light with Poor Contrast — This problem usually results from exhausted or contaminated developing solution or insufficient developing time. Drain, clean and refill tanks with fresh, properly mixed chemicals. Then check temperature for proper developing time.

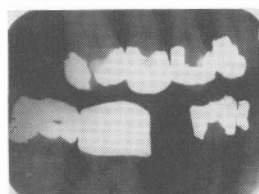


25239-P10

Radiographic Result

Radiographic Goal

Film is Too Grey with Poor Contrast — This problem is caused by underdeveloping along with fog. Fog is usually caused by contaminated, exhausted, or too warm developing solution. Too much darkroom light, aged film or overdeveloping are other causes. Drain, clean and refill developing tanks with fresh, properly mixed chemicals. Then check temperature, darkroom light, and develop unexposed film. If fog appears, try fresh film.



25240-P10

Radiographic Result

Radiographic Goal

Film is Too Dark with Poor Contrast — This problem results from normal or overexposure along with fogging. Make certain that exposure times are correct for the cone being used. (See **Recommended Exposure Times**). Then check the processing chemicals, temperature, developing time, darkroom light, and film date.

SYSTEM SPECIFICATIONS

Cooling and duty rating specifications apply at altitudes up to 12,000 ft. (3,600 m), average relative humidity not exceeding 95 percent, and maximum ambient temperature not exceeding 80°F (27°C).

TUBE HEAD SPECIFICATIONS

Maximum Rated Peak Tube Potential: 70 kVp at 7 mA tube current.

Minimum filtration (permanently installed in the useful beam): 1.5 mm aluminum equivalent at 70 kVp.

Leakage Technic Factors: 70 kVp and 0.12 mA tube current.

Typical Half Value Layer: 2.0 mm aluminum at 70 kVp.

CONE SPECIFICATIONS

X-ray Field Size: Containable in a 6.5 cm diameter circle, measured at the distal end of the installed cone.

Distance from focal spot to the base of the cone (either 8 or 12 in cone): approximately 5.5 inches (14cm).

Distance from the focal spot to the distal end of the cone is: 8 or 12 in. (20.3 or 30.5 cm).

Nominal Roentgen output* for 70 kVp, 7 mA at the distal end of the cone, for a new system: 0.8 R/sec at 8 in. and 0.4 R/sec at 12 in.

* Variations of up to +50%, -55% may be realized due to measurement instrumentation, installation variables, age, use history, and manufacturing tolerances.

POWER SUPPLY REQUIREMENTS

Line voltage must be in the range 110 to 130 volts rms, 60 Hz. Abrupt changes in voltage caused by other loads should be infrequent, and of short duration.

Line Current (during an exposure): 10 amps maximum. Technic factors constituting the maximum line current condition are fixed at 70 kVp and 7 mA.

Line Voltage regulation must not exceed 4 percent at 70 kVp, 7 mA.

OVERALL ACCURACY OF TECHNIC FACTORS

Line Voltage (AC no-load)	110-130
Nominal Peak Tube Potential	70 kVp +/- 10 kVp
Nominal Tube Current	7 mA +/- 2 mA
Exposure Time	+/- 2 pulses of selected value

MEASUREMENT BASIS

Each exposure is preceded by a filament warm up time of about 22/60 seconds. During this time, a low level of radiation is produced. The peak tube potential varies during the filament warm up from approximately 60 to 80 kVp. Although the amount of radiation produced during this time is small, it is useful and contributes to forming the image on the film.

When the exposure time starts, the first several x-ray pulses will be high kVp (about 80), low mA (about 2), and will settle out to 70 kVp and 7 mA (nominal) after 5-10 pulses.

1. Peak Tube Potential: As measured with a high voltage divider network using an exposure time of 15 pulses or more.

2. Tube Current: The average value of anode to cathode current as measured with a DC mA meter using an exposure time of approximately 3 seconds.

3. Exposure Time: The total time is equal to the filament warm-up time of 22 pulses plus the selected exposure time. Therefore, the exposure time is measured using a pulse counter connected to the primary of the high voltage transformer and subtracting 22 pulses from the measured value. A "pulse" is the half of the line power cycle during which the x-ray tube conducts.

4. Half value layer and Roentgen output are measured on a new (unused) system installed on a 115 volt, 60 Hz line with 2% regulation and calibrated to the midrange values of the manufacturer's recommendations. Exposure times shall be one second.

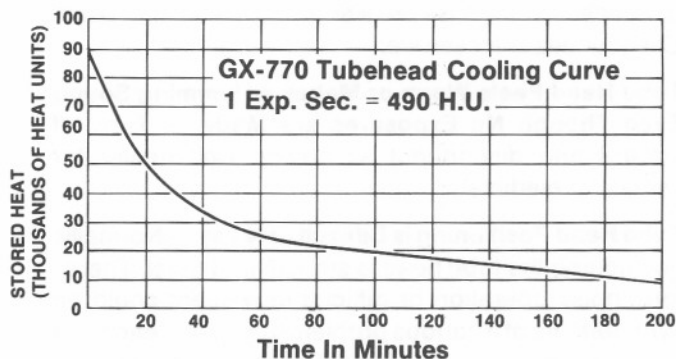
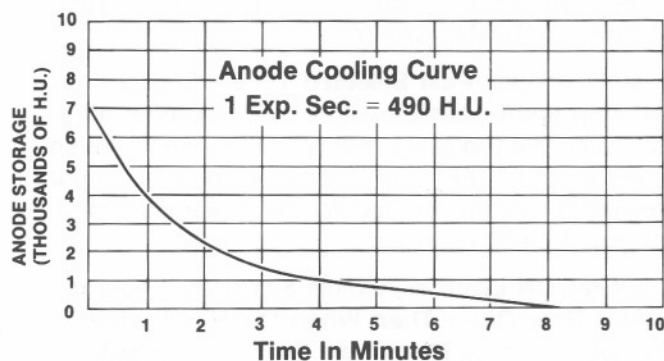
DUTY CYCLE

The maximum allowable duty cycle is 1:60. That is, a user or service person must not exceed one unit of "on-time" for every 60 units of "off-time". For example: a maximum exposure rate would be a 32 pulse exposure every 32 seconds or a 62 pulse exposure every 62 seconds.

Exposure made for service calibration purposes may be as long as approximately 3 seconds (in calibration mode). These exposures should not be repeated more frequently than every 3 minutes.

TUBE RATING CHART

Single Exposure — 70 kVp, 7 mA, 3 seconds maximum



PERIODIC MAINTENANCE

In the interest of equipment safety, a maintenance program must be established. It is the owner's responsibility to arrange for this service, and to assure that personnel performing this are fully qualified to service GENDEX Dental X-ray equipment.

The calibration and adjustments to be performed are listed in the System and Function Checks Section in the GX-770 Installation/Maintenance Manual provided with the equipment. The System and Function Check is to be performed at installation and every twelve months thereafter.

They include:

mA Check
Vref
Vcal Adjustment
Line Regulation

Cone
Exposure Switch
Mounting

Exposure Time Check
Arm Balance
Tube Head Rotation
Tube Head/Suspension Drift
Labels
Tube Head Damage
Power ON Light

Indication of
Technic Factors
Premature
Termination
Exposure
Indication
Beam Size

For owner convenience, a Maintenance Record is provided below.

To clean the control panel and painted surfaces, use a cloth moistened in warm soapy water made with a mild soap. Wipe with a clean cloth moistened in clear water. Do not use cleaners or solvents.

MAINTENANCE RECORD

Installed By: _____

Date: _____

12-Month Maintenance Check

6-Year Maintenance Check

By: _____ Date: _____

By: _____ Date: _____

2-Year Maintenance Check

7-Year Maintenance Check

By: _____ Date: _____

By: _____ Date: _____

3-Year Maintenance Check

8-Year Maintenance Check

By: _____ Date: _____

By: _____ Date: _____

4-Year Maintenance Check

9-Year Maintenance Check

By: _____ Date: _____

By: _____ Date: _____

5-Year Maintenance Check

10-Year Maintenance Check

By: _____ Date: _____

By: _____ Date: _____

DENTSPLY

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